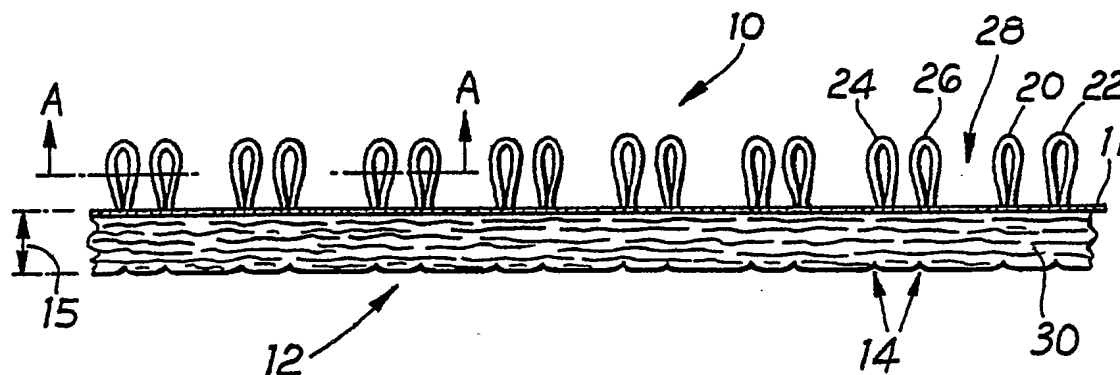




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/GB91/01609 <b>(22) International Filing Date:</b> 19 September 1991 (19.09.91) <b>(30) Priority data:</b> 9020623.6 21 September 1990 (21.09.90) GB <b>(71) Applicant:</b> HECKMONDWIKE FB LIMITED [GB/GB]; P.O. Box 7, Wellington Mills, Liversedge, West Yorkshire WF15 7XA (GB). <b>(72) Inventors:</b> GORDON, Douglas, Alexander ; Chalgrove, Skircoat Green Road, Halifax, West Yorkshire HX3 0LJ (GB). SHEARD, Barrie ; 7 Almondroyd, Heckmondwike WF16 9BP (GB). <b>(74) Agent:</b> GOODMAN, Christopher; Eric Potter & Clarkson, St Mary's Court, St Mary's Gate, Nottingham NG1 1LE (GB).		<b>(81) Designated States:</b> AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB, GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** GROUND STABILISATION AND SUPPORT MATERIAL**(57) Abstract**

A resin bonded fabric material (10) is formed with ribs (20, 22, 24, 26) upstanding from a stiff backing layer (30) the ribs (20, 22, 24, 26) forming furrows (28) between adjacent ribs to thereby provide stability for loose particles.

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GROUND STABILISATION AND SUPPORT MATERIAL

The present invention relates to a ground stabilisation and support material and more particularly to  
5 a fabric which provides stabilisation for loose materials and a carrier for bonded particles.

It is an object of the present invention to provide a fabric which is capable of stabilising loose particles,  
10 providing support for bonded structures and adding dimensional strength to the profile of a structure.

The present invention provides a ground stabilisation and support material comprising a fabric material, the  
15 fabric material being three dimensional and being formed with ribs upstanding from a stiff base structure layer, the stiff base structure layer including a scrim, the ribs forming furrows between adjacent ribs the fabric being free draining and resin bonded.

20

The present invention incorporates a scrim of sufficient density to minimize the migration of particles through the structure.

25 Preferably the thickness of the fabric varies from 6 mm to 40 mm and the fabric is formed with a flat backing on the opposite side to the ribs.

The fabric is preferably constructed by needle punching a flat cloth made of synthetic/man made fibres or natural fibres containing a scrim into a ribbed construction which resembles a furrow formed by a plough or  
5 other agricultural implement. The furrows are however preferably relatively narrow. In a preferred embodiment the furrows are less than 20 mm wide.

The ribs are preferably formed in parallel rows by  
10 looping vertical fibres, the other side of the fabric being relatively flat but with a slightly lined appearance.

In a preferred embodiment the ribs are formed in double rows closely spaced with a furrow being formed  
15 between each double row formation.

A resin bond is added to the fabric to provide additional stiffness by through bonding or back coating.

20 When laid the fabric is impregnated with particles of either natural or man made material.

The stiffness and shock absorbency of the structure will depend on the type of particles used and varying  
25 levels of stability on the distance apart of the ribs, thickness of the flat side of the structure and the fibre density of the fibres.

The fabric may be laid with the ribs upwards or downwards. The fabric may be used as a base or a sub-base component at varying depths within a structure or as part of a surfacing material. The present invention also provides a stabilised ground structure including a foundation layer comprising soil or stone, a fabric material laid on top of the foundation layer and a surface laid on top of the fabric material, in which the fabric material is three dimensional and is formed with ribs upstanding from the upper surface of a stiff base structure, the ribs forming furrows between adjacent ribs, the fabric being free draining and in which the furrows are filled with particulate material which assists in supporting the surface layer.

15

The present invention also provides a stabilised ground structure including a foundation layer comprising particulate material, a fabric material laid on top of the foundation layer and a surface layer laid on top of the fabric material, in which the fabric material is three dimensional and is formed with ribs down turned from the lower surface of a stiff base structure layer, the ribs forming furrows between adjacent ribs, the fabric being free draining and in which the furrows are filled with the particulate material comprising the foundation layer.

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Embodiments of the present invention will now be described, by way of example with reference to the

accompanying drawings in which:-

Figure 1 shows a cross-sectional view of a portion of a fabric material according to the present invention;

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Figure 2 shows a cross-section along line A-A of Figure 1 illustrating the ribbed formation;

Figure 3 shows a fabric according to the present invention in situ forming part of a first structure;

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Figure 4 shows a fabric according to the present invention in situ as part of a second structure;

Figure 5 shows part of the structure of Figure 3 in greater detail;

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Figure 6 shows part of the structure of Figure 4 in greater detail; and

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Figure 7 shows a fabric according to the present invention in situ as part of a third structure.

With reference now to Figures 1 and 2 the fabric 10 comprises a ribbed construction with ribs 20, 22 which in this embodiment are formed closely together as shown and are spaced apart from an adjoining set of ribs 24, 26 by a furrow 28.

25

The fabric 10 provides a ribbed construction fabric for stabilising loose particulate materials and providing a carrier for bonded particles (see Figures 3 to 7).

- 5        The fabric 10 comprises a three dimensional fabric of varying thickness from 6 mm to 40 mm with a flat backing on one side 12 and ribs 20, 22, 24, 26 on the opposite side.

10        The fabric 10 is constructed by needle punching a flat cloth, made of synthetic/man made fibres or natural fibres containing a scrim 11, into the ribbed construction which resembles a furrow formed by a plough or other agricultural implement.

- 15        The ribs 22 etc are formed in rows by looping vertical fibres whereas the other side 12 of the fabric remains flattish but with a slightly lined appearance 14.

20        The fabric 10 is capable of stabilising loose particles, providing support for bonded structures and adding dimensional strength to the profile of a structure such as shown in Figures 3 to 7. In all versions of the product, a resin bond is added to stiffen the fabric by through bonding or back coating. The fabric once filled  
25        with particles which may include both natural and man-made can provide varying degrees of stiffness and shock absorbency depending on the type of particles used and varying levels of stability according to the distance apart

of the ribs, the thickness of the flat side of the structure and the fibre density of the fibres. The fabric 10 is designed to be used with the ribs downwards (Figures 4 and 6) or upwards depending on the application and the degree of dimensional stability, shock absorbency, and stiffness required.

The fabric 10 can be used as a base or sub-base component at varying depths within a structure or as part of a surfacing material. The fabric 10 provides a means of stiffening a structure in order to improve its load bearing qualities.

The fabric 10 can be made very stiff if required by increasing the bonding agent 15 within its structure or as part of the particulate mix applied into the fabric.

Because of its flexibility, the fabric 10 assists a stiffened layer in staying as a unit, rather than cracking should there be movement in the base or subgrade formation. This means that on the surface of a structure levels of evenness/smoothness will "roll" over a greater span, rather than forming a major depression which can happen with bonded structures where no horizontal support is provided.

25

The fabric material 10 can be manufactured in various grades in order to provide the most economical way of fulfilling a desired role.



The ribs 20 etc may be of any required height but are generally in the range from 3 mm to 35 mm. The base structure layer 30 must be of sufficient depth to provide the required stiffness to the fabric and is generally in  
5 the range 1 mm to 12 mm.

The ribs may be formed singly as shown in Figures 3 to 7 or in two or more closely spaced formations with the furrow 28 between each formation.

10

The fabric is used in structures examples of which will now be described with reference to Figures 3 to 7.

In Figure 3 the fabric 10 is laid on top of soil 40 or  
15 a stone base 50. The surface of the soil/or stone may be prepared by rolling to provide a flat surface. The fabric is then filled with a particulate material 60 and if required a top surface 70 of for example a recreational surface may be provided.

20

The upstanding ribs 20 etc provide a key for the particulate material 60 and the base layer 30 provides stiffness which adds support to the stone or soil base. The furrows 28 provide a large space for the particulate  
25 material 60 allowing a large amount of particulate material to fill the furrows. A smaller amount of the particulate material will penetrate the ribs 20 etc. As described above the ribs 20 etc and base 30 may in a preferred embodiment

be resin bonded to provide additional rigidity for the fabric and hence the structure. In all cases the fabric is free draining thereby allowing drainage. The effect of any hollows formed under the fabric will be evened out by the fabric.

In Figure 5 the structure of Figure 3 is shown in greater detail.

In Figure 4 the fabric is laid on a prepared particulate base 60' with the ribs 20 etc underneath. The under surface 14 provides a reasonably flat surface to walk on but if preferred a top surface of artificial turf 70 may be laid thereon.

15

The ribs 20 etc and base structure layer 30 provide as in Figure 3 a keying action and a stiffening action protecting the layer of particulate material 60' and preventing sideways movement.

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The structure is shown in greater detail in Figure 6.

With reference to Figure 7 in an alternative structure similar to Figure 3 the particulate material 60 is replaced by bonded particulate material 600. This forms a more rigid structure which may be impervious to water dependent on the

bonding. The bonded particulate may be laid after laying the fabric 10 and other material 700 may be added on top to make the fabric an intermediate layer in a construction.

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CLAIMS

1. A ground stabilisation and support material comprising  
5 a fabric material, the fabric material being three dimensional and being formed with ribs upstanding from a stiff base structure layer, the stiff base structure layer including a scrim, the ribs forming furrows between adjacent ribs the fabric being free draining and resin  
10 bonded.
2. A ground stabilisation and support material as claimed in claim 1 in which the scrim is of sufficient density to minimise migration of particles through the structure.  
15
3. A ground stabilisation and support material as claimed in claim 2 in which the thickness of the fabric varies from 6 mm to 40 mm and in which the fabric is formed with a flat backing on the opposite side to the ribs.  
20
4. A ground stabilisation and support material as claimed in claim 1,2 or 3 in which the fabric is constructed by needle punching a flat cloth made of synthetic/man made fibres or natural fibres containing a scrim, into a ribbed  
25 construction which resembles a furrow formed by a plough or other agricultural implement.
5. A ground stabilisation and support material as claimed

in claim 4 in which the furrows are less than 20 mm wide.

6. A ground stabilisation and support material as claimed in claim 5 in which the ribs are formed in parallel rows by looping vertical fibres, the other side of the fabric being relatively flat but with a slightly lined appearance.

7. A ground stabilisation and support material as claimed in claim 6 in which the ribs are formed in double rows closely spaced with a furrow being formed between each double row formation.

8. A ground stabilisation and support material as claimed in any one of claims 1 to 7 in which the resin bond is added to the fabric to provide additional stiffness by through bonding or back coating.

9. A ground stabilisation and support material as claimed in any one of claims 1 to 8 in which when laid the fabric is impregnated with particles of either natural or man made material.

10. A ground stabilisation and support material as claimed in claim 9 in which the stiffness and shock absorbency of the structure is selected according to the type of particles used and varying levels of stability on the distance apart of the ribs, thickness of the flat side of the structure and the fibre density of the fibres.

11. A ground stabilisation and support material as claimed in claim 10 in which the fabric is laid with the ribs upwards or downwards and in which the fabric is used as a base or a sub-base component at varying depths within a structure or as part of a surfacing material.

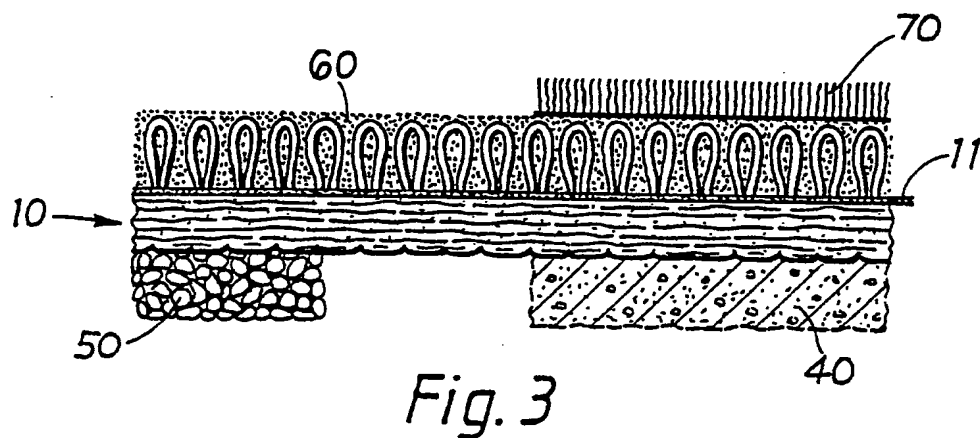
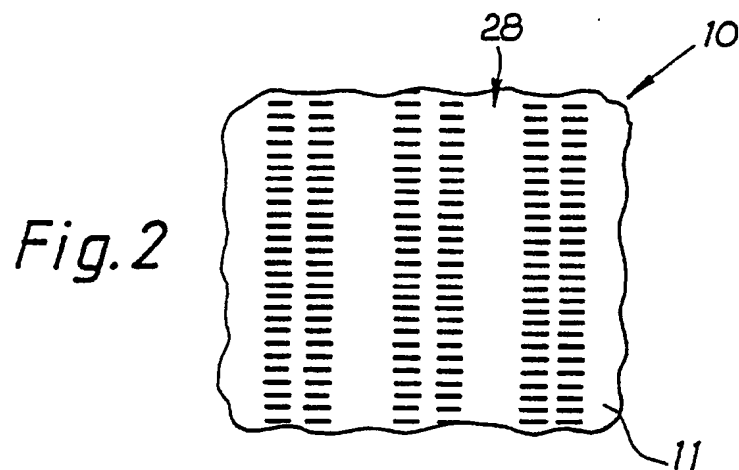
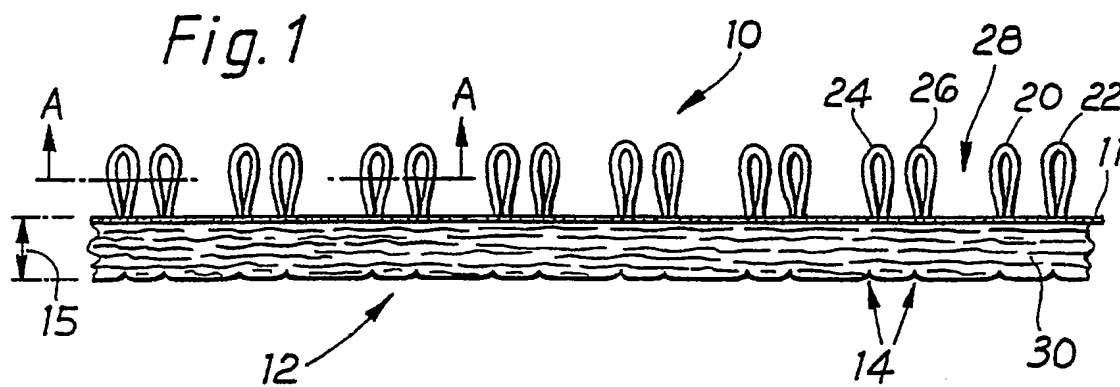
12. A stabilised ground structure including a foundation layer comprising soil or stone, a fabric material laid on top of the foundation layer and a surface layer laid on top of the fabric material, in which the fabric material is three dimensional and is formed with ribs upstanding from the upper surface of a stiff base structure layer, the ribs forming furrows between adjacent ribs, the fabric being free draining and in which the furrows are filled with particulate material which assists in supporting the surface layer.

13. A stabilised ground structure including a foundation layer comprising particulate material, a fabric material laid on top of the foundation layer and a surface layer laid on top of the fabric material, in which the fabric material is three dimensional and is formed with ribs down turned from the lower surface of a stiff base structure layer, the ribs forming furrows between adjacent ribs, the fabric being free draining and in which the furrows are filled with the particulate material comprising the foundation layer.

14. A ground stabilisation and support material substantially as described with reference to the accompanying drawings.

5 15. A stabilised ground structure substantially as described with reference to the accompanying drawings.

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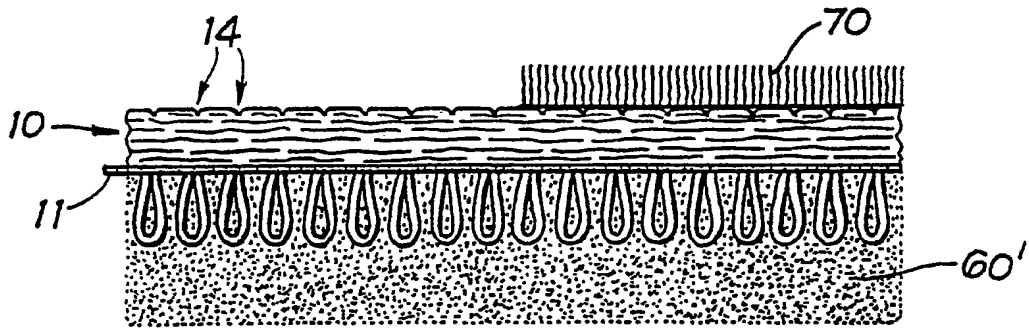


Fig. 4

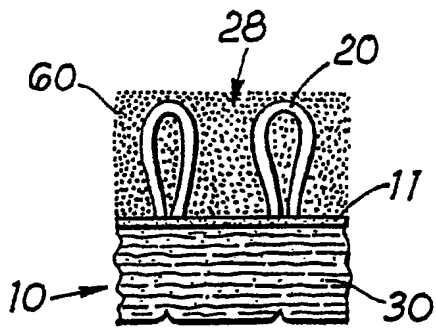


Fig. 5

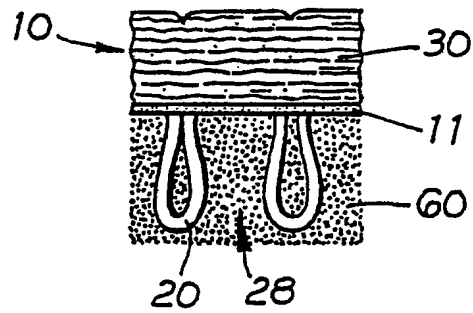


Fig. 6

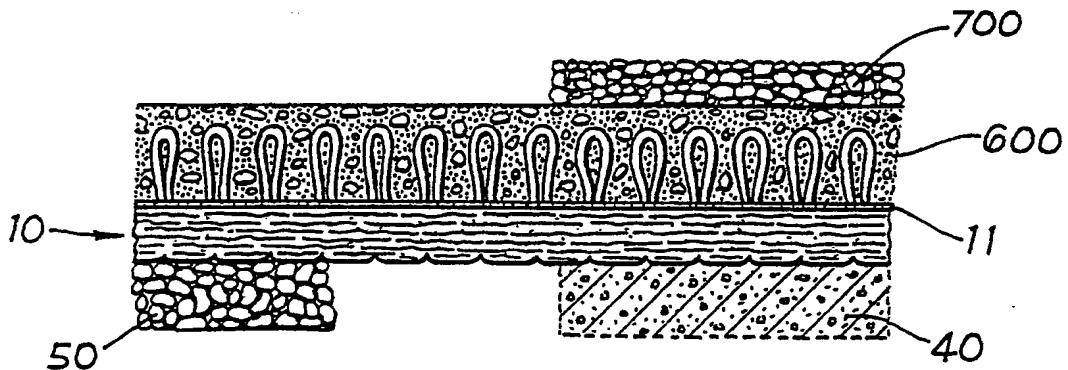



Fig. 7

## INTERNATIONAL SEARCH REPORT

PCT/GB 91/01609

International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 E02D17/20; E01C13/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	E02D ; E01C ; E02B ; A01G	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	EP,A,0 174 755 (NOTTINGHAMSHIRE COUNTY COUNCIL) 19 March 1986	1,9
A	see page 4, line 27 - page 7, line 6; figures 1-5	2-8,10
A	DE,U,8 807 142 (HUBNER) 27 October 1988	1,3,5-7, 9-12,14, 15
	see page 1, line 1 - line 7 see page 2, line 8 - page 3, line 13; figures 1-5	
A	DE,A,3 805 069 (BEHRENS) 21 September 1989	1-3,6, 11-13
	see column 3, line 20 - column 4, line 39; figures 1-3	
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
20 DECEMBER 1991	13. 01. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	TELLESEN J. 	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9101609  
SA 51571

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0174755	19-03-86	AU-B- 575680	04-08-88
		AU-A- 4664085	27-02-86
		CA-A- 1253896	09-05-89
DE-U- 8807142	27-10-88	None	
DE-A- 3805069	21-09-89	None	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82